

of fog about corresponded in number with the average of the last two years. Over and near the Grand Banks fog was reported on the 10th, with high barometer and winds mostly from the southeast; and on the 19th, 20th, and 27th, with the advance or passage to the northward of areas of low pressure. Between the fifty-fifth and fifty-sixth meridians fog was reported on the 10th, with high barometer and variable winds; and on the 19th, 20th, and 30th with the passage of areas of low pressure to the northward. West of the sixty-fifth meridian fog was reported on the 9th and 19th, with areas of low pressure central in the Saint Lawrence Valley, and on the 10th, with high pressure and variable winds. Very dense fog prevailed

at New York City, Philadelphia, and Baltimore from the 18th to 20th. At New York City, on the 20th, there were many collisions in the North and East rivers; accidents on the elevated railroads and on the bridge; ocean steamers could not leave their docks, and no vessels entered port. At Philadelphia, navigation was almost suspended on the Delaware River and in the Bay. At Baltimore, navigation was greatly interfered with; vessels were obliged to anchor, and the detention of vessels caused a loss of thousands of dollars. On these dates unsettled weather and rain prevailed, attending the passage of areas of low pressure over the Lake region and the Saint Lawrence Valley.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for December, 1889, is exhibited on chart ii by dotted isotherms. In the table of miscellaneous meteorological data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. The monthly mean temperature for regular stations of the Signal Service represents the mean of the maximum and minimum temperatures.

For December, 1889, the mean temperature was highest over extreme southern Florida and in the lower Rio Grande valley, where it was above 70°. On the Atlantic coast south of Savannah, Ga., along the east Gulf coast, over Louisiana, southwestern Arkansas, and a greater part of the eastern half of Texas the mean values were above 60°. The mean temperature for the month was above 50° south of a line traced irregularly westward from southeastern Virginia to extreme northern Texas, and thence southwestward to south-central New Mexico; it was also above 50° south of a line traced from southeastern Arizona northwestward to San Francisco, Cal. The mean temperature was lowest in northern North Dakota, northeastern Montana, and in the British Possessions to the northward, where it fell below 10°. The mean values were below 20° in the Saint Lawrence Valley east of the seventy-second meridian, in northern and extreme western Ontario, and north of a line traced from the north shore of Lake Superior south of west to southern North Dakota, and thence north of west to the region north of extreme western Montana. The mean readings were also below 20° within a limited area in extreme west-central Montana. The mean temperature was below 30° in the upper Saint Lawrence valley, in northern New England, extreme northern New York, in the upper lake region north of the forty-fifth parallel, and north of a line traced thence westward to southwestern South Dakota, thence northwest to central Montana, thence southward to central Utah, thence northwestward to west-central Idaho, thence southwest to extreme northeastern California, and thence irregularly northward to north-central Washington. The mean readings were also below 40° within a limited area in south-central Colorado.

The mean temperature for December, 1889, was above the normal, except in the Pacific coast states, western Montana, northern Idaho, and western Nevada. Sacramento, Cal., was the only Signal Service station on the Pacific coast where the mean temperature was above the normal, and the excess at that place was but 0°.5. The most marked departures above the normal temperature occurred within an area embracing the lower Ohio valley and Tennessee, Arkansas, Missouri, and Iowa, where they generally exceeded 15°, the greatest excess, 17°.2, being reported at Cairo, Ill., and Memphis, Tenn. Along

the Pacific coast the departures below the normal temperature were less than 5°.

The following are some of the most marked departures from the normal at the older established Signal Service stations:

Above normal.		Below normal.	
Cairo, Ill., and Memphis, Tenn	17.2	Olympia, Wash	4.4
Des Moines, Iowa	15.6	San Diego, Cal	3.6
San Antonio, Tex	13.0	Red Bluff, Cal	3.2
Lynchburg, Va.	11.6	Winnemucca, Nev	2.8
Cheyenne, Wyo	8.5	Helena, Mont	1.4

THE HIGH TEMPERATURE OF DECEMBER, 1889.

The remarkable excess of temperature for December, 1889, is exhibited by the following table, which shows that at sixty-five out of a total of eighty-six Signal Service stations east of the Rocky Mountains and south of the upper lake region, and in the middle and southern plateau regions, having a record of ten years, or more, the mean temperature was the highest ever noted for December. The table also gives for the stations named the highest mean temperature previously recorded for December, with the year of occurrence; the excess of temperature for the current month over the highest previous record for December; the annual mean temperature for 1889; and the departures of the annual mean temperature for 1889 from the annual normal temperature:

Station.	Length of record.	Mean temperature, Dec., 1889.	Departure from normal.	Highest previous mean for Dec.	Year of occurrence.	Excess, Dec., 1889.	Annual mean temperature, 1889.	Departure from annual normal.
Boston, Mass.	19	38.0	+ 6.0	37.8	1881	0.2	50.7	+ 12.9
New Haven, Conn.	18	38.8	+ 7.8	38.0	1877	0.8	50.6	+ 11.8
New London, Conn.	18	40.0	+ 7.0	39.3	1881	0.7	51.3	+ 12.0
New York City	20	41.4	+ 7.4	40.7	1881	0.7	53.5	+ 12.3
Philadelphia, Pa.	19	43.6	+ 7.6	41.7	1881	1.9	54.8	+ 13.1
Atlantic City, N. J.	17	43.6	+ 7.6	42.2	1881	1.4	52.3	+ 10.6
Baltimore, Md.	18	46.0	+ 9.0	43.1	1877	2.9	55.8	+ 12.6
Washington City.	20	45.6	+ 9.6	41.8	1877	3.8	55.1	+ 13.4
Cape Henry, Va.	16	52.4	+ 9.4	51.7	1879	0.7	58.9	+ 17.2
Lynchburg, Va.	17	50.6	+ 11.6	46.0	1877	4.6	57.2	+ 11.3
Norfolk, Va.	19	51.4	+ 8.4	50.0	1879	1.4	59.1	+ 19.1
Charlotte, N. C.	12	54.7	+ 10.7	49.1	1879	5.6	60.6	+ 11.5
Hatteras, N. C.	10	54.6	+ 6.6	52.1	1881	2.5	61.2	+ 6.0
Kitty Hawk, N. C.	15	54.0	+ 9.0	53.1	1879	0.9	.....	.....
Wilmington, N. C.	19	56.0	+ 7.0	55.6	1879	0.4	62.8	+ 6.2
Charleston, S. C.	17	60.0	+ 9.0	57.9	1879	2.1	65.6	+ 5.6
Augusta, Ga.	17	57.4	+ 9.4	53.9	1879	3.5	64.5	+ 6.5
Savannah, Ga.	19	59.8	+ 6.8	58.5	1879	1.3	65.6	+ 7.1
Atlanta, Ga.	12	57.2	+ 13.2	50.9	1879	6.3	61.1	+ 10.1
Pensacola, Fla.	11	62.0	+ 8.0	58.5	1881	3.5	67.1	+ 6.6
Mobile, Ala.	19	61.0	+ 9.0	57.5	1875	3.5	66.4	+ 8.9
Montgomery, Ala.	18	59.1	+ 10.1	54.4	1875	4.7	65.3	+ 10.9
Vicksburg, Miss.	18	63.6	+ 13.6	56.5	1875	7.1	65.0	+ 8.5
New Orleans, La.	20	64.3	+ 9.3	61.6	1875	2.7	68.8	+ 10.5
Shreveport, La.	17	63.2	+ 13.2	55.3	1875	7.9	65.9	+ 10.6
Fort Smith, Ark.	6	57.8	.....	44.1	1883	13.7	61.6	+ 13.6
Little Rock, Ark.	11	59.1	+ 15.1	49.2	1881	9.9	61.8	+ 12.6
Galveston, Tex.	19	66.4	+ 9.4	61.5	1877	4.9	69.3	+ 7.8
Palestine, Tex.	8	64.2	.....	53.8	1883	10.4	66.2	+ 12.5
San Antonio, Tex.	11	66.0	+ 13.0	59.0	1879	7.0	67.8	+ 8.8
Brownsville, Tex.	15	71.1	+ 10.1	66.7	1879	4.4	73.0	+ 6.3
Rio Grande City, Tex.	12	71.2	+ 11.2	63.3	1879	7.9	73.6	+ 10.3
Chattanooga, Tenn.	11	57.2	+ 15.2	49.2	1879	8.0	60.4	+ 11.2

High temperature of December, 1889—Continued.

Station.	Length of record.	Mean temperature, Dec., 1889.	Departure from normal.	Highest previous mean for Dec.	Year of occurrence.	Excess, Dec., 1889.	Annual mean temperature, 1889.	Departure from annual normal.
Knoxville, Tenn.	19	54.1	+15.1	47.3	1879	6.8	58.2	+10.9
Memphis, Tenn.	17	60.2	+17.2	50.1	1877	10.1	62.2	+11.3
Nashville, Tenn.	20	56.4	+16.4	49.0	1875	7.4	59.1	+10.1
Louisville, Ky.	18	51.6	+13.6	48.5	1877	3.1	56.8	+10.2
Indianapolis, Ind.	16	45.7	+15.7	46.3	1877	0.4	53.1	+10.4
Cincinnati, Ohio.	20	48.2	+13.2	43.6	1875, 1881	4.6	54.8	+10.5
Columbus, Ohio.	12	44.6	+13.6	39.7	1881	4.9	52.2	+10.3
Pittsburgh, Pa.	17	45.6	+11.6	42.5	1877	3.1	53.4	+10.4
Buffalo, N. Y.	17	37.5	+7.5	36.6	1881	0.9	47.1	+10.8
Rochester, N. Y.	19	35.6	+5.6	36.1	1881	0.5	47.3	+10.8
Erie, Pa.	17	40.8	+8.8	40.4	1877	0.4	48.7	+10.0
Cleveland, Ohio.	18	42.0	+12.0	40.4	1877	1.6	49.8	+11.1
Sandusky, Ohio.	13	41.6	+11.6	41.2	1877	0.4	49.9	+10.0
Toledo, Ohio.	19	41.6	+11.6	40.9	1877	0.7	49.8	+10.0
Des Moines, Iowa.	12	39.6	+15.6	35.0	1881	4.6	49.9	+11.6
Cairo, Ill.	18	54.2	+17.2	50.1	1877	4.1	57.9	+10.2
Springfield, Ill.	11	44.4	+13.4	39.9	1881	4.5	52.2	+10.2
Saint Louis, Mo.	19	49.8	+14.8	47.9	1877	1.9	56.0	+10.5
Leavenworth, Kans.	19	45.3	+14.3	44.1	1877	1.2	53.9	+10.9
Omaha, Nebr.	17	39.4	+15.4	38.9	1877	0.5	51.2	+10.9
Fort Sully, S. Dak.	11	27.6	+7.6	27.0	1875	0.6	46.5	+12.4
Yankton, S. Dak.	17	34.4	+14.4	32.8	1881	1.6	48.6	+13.1
Cheyenne, Wyo.	17	35.5	+8.5	34.2	1875	2.3	45.7	+11.5
North Platte, Nebr.	16	37.2	+9.2	34.6	1875	2.6	48.8	+11.2
Denver, Colo.	19	40.5	+7.5	39.1	1881	1.4	50.0	+10.7
Dodge City, Kans.	16	44.6	+13.6	41.0	1875	3.6	54.3	+11.5
Fort Sill, Ind. T.	13	53.8	+13.8	47.0	1877	6.8	60.2	+10.2
Abilene, Tex.	5	59.6	+19.6	49.4	1885	10.2	63.3	+10.1
El Paso, Tex.	12	53.2	+7.2	49.7	1879	3.5	64.1	+10.8
Santa Fe, N. Mex.	17	39.8	+8.8	34.0	1886	5.8	49.8	+11.7
Fort Apache, Ariz.	12	45.3	+7.3	40.3	1886	6.0	56.2	+13.1
Fort Grant, Ariz.	12	51.0	+5.0	50.8	1886	0.8	61.6	+11.4
Fort Thomas, Ariz.	10	50.3	+7.3	45.5	1883	4.8	64.8	+10.0
Whipple Barracks, Ariz.	14	42.2	+4.2	40.5	1886	1.7	53.1	+10.6
Salt Lake City, Utah.	16	39.6	+5.6	36.6	1886	3.0	52.7	+11.2

NOTE.—At San Diego, Cal., nineteen years record, the mean temperature, 52° 4, was the lowest ever reported for December; the mean in 1874, 53° 3, being the lowest mean temperature previously reported for the month of December.

The general causes which contributed to produce the unprecedentedly high temperature of December, 1889, over the country east of the Rocky Mountains and south of the upper lake region can be better determined by considering the distribution of pressure, the number and course of low pressure storms, and the prevailing winds for the month. The charted reports show that an area of high pressure occupied the southern states east of the Mississippi River; that the pressure averaged about one-tenth of an inch above the normal in that region; and that there was a decrease in pressure northward to Canada. Reports also show that no low pressure storms traversed the country east of the Mississippi River south of the fortieth parallel, a feature for December without a parallel in the history of the Signal Service, and that there was an unusual prevalence of low pressure storms over and north of the Lake region. It also appears that the prevailing winds were southerly, whereas the normal wind-directions for December in the regions referred to are westerly or north-westerly. It is a fairly well-established fact that low pressure storms are deflected when their advance along the usual paths of storms is intercepted or barred by areas of high pressure. That this effect was produced by the almost continuous presence of areas of high pressure over the Gulf States during December, 1889, can be seen by referring to the chart upon which are plotted the tracks of low pressure storms for that month. The distribution of pressure and the course of low pressure storms combined to cause a drift of the warm air of the Gulf States over the districts to the northward, the abnormal movement of the lower air currents being due to the well-known law that the winds blow from a region of high pressure towards a region of low pressure, and to the recognized fact that there is a large inflow of surface air into low pressure storms.

The centre of the area of highest pressure was in Georgia, and, following the well known law of the circulation of the winds around a centre of high barometer, the prevailing winds east of the Mississippi River and south of a line connecting

New Orleans, La., and Jacksonville, Fla., were from the north; in the west Gulf states and central valleys they were from the south and southwest. This distribution of pressure prevented an indraught of moist air from the Gulf of Mexico over the east Gulf states, and the deficiency of rainfall was greatest in these states. While the winds in the west Gulf states and central valleys were from the south, the slight barometric gradient from the Gulf of Mexico northward over these districts gave rise to a system of air circulation of feeble energy which was, as is usual in such systems, deficient in precipitation, and it was not until north of the parallel of 40°, where the barometric ranges were large, that the rainfall was above the average for the month. The deficiency in moisture and clouds over the central valleys permitted the receipt of an unusual amount of solar radiation, which, added to the excess of temperature produced by the southerly winds, caused in these districts the greatest departures from the normal for the month and higher temperature than ever before recorded for December.

It is proper to note in connection with the abnormal temperature and precipitation conditions east of the Rocky Mountains and south of the upper lake region, that on the Pacific coast a reverse of these conditions obtained, more especially in California, where the precipitation was about three times greater than the average amount for December; where the temperature was below the normal; and where, at San Diego, the mean temperature was the lowest noted for December since the establishment of that station in 1871. The contrasts in temperature and precipitation thus presented in different sections of the country seem to farther prove the correctness of the assumptions concerning the causes of the abnormally warm and dry weather in the middle and southern states east of the Rocky Mountains.

In the column showing the year of occurrence of the highest previous mean temperature for December it will be seen that the warmest December over a greater part of the country east of the Rocky Mountains, as shown by Signal Service records, was noted in 1877. In that year the excesses in temperature occurred at a majority of stations from the one hundredth meridian eastward over a greater part of the Lake region, the lower Missouri valley, Indian Territory, northern Arkansas, the Ohio Valley, Virginia, and the District of Columbia. In the south Atlantic states and Florida the warmest previous December was in 1879, and in the Gulf States in 1879 or 1875. In 1877, as in the current year, an area of unusually high pressure occupied the southeastern states in December; the number of low pressure storms was in excess of the average number for the month, numbering the same as for the current month; and but one low pressure storm traced east of the Mississippi River and south of the fortieth parallel reached the Atlantic coast. In December, 1879, very similar barometric conditions prevailed; the low pressure storms were largely in excess of the average number for the month; and but one low pressure storm traversed the country east of the Mississippi River and south of the fortieth parallel. In contradistinction to the instances cited and the apparent causes of abnormally warm Decembers, it is interesting to note in connection with the coldest December in the history of the Signal Service over the eastern part of the country, that of 1876, that an area of unusually high pressure extended over and west of the lower Mississippi valley; that a similar area occupied eastern Dakota; and that three well-defined and energetic low pressure storms traversed the Gulf States.

It is also interesting to note that although the temperature for December, 1889, was largely in excess of the normal, and was higher than ever before recorded for the corresponding month of previous years at a majority of stations in the southern, middle-eastern, and southeastern parts of the country, the departures of the annual mean temperature for 1889 from the annual normal temperature for the stations named were small, and that at a number of stations the mean temperature for the year was below the normal. It will therefore be seen that the average temperature for the year in the sections re-

ferred to corresponded very closely with the normal, and that the unprecedented warmth of December, 1889, to which the small excesses in temperature for the year were principally due, was caused by the abnormal distribution of pressure, the unusual course of low pressure storms, and, incidentally, to the consequent and unusual prevalence of southerly winds over the regions represented by the stations named in the table.

For the year 1889 there has been an average excess in temperature of 39°.5 in the extreme northwest; of 22°.4 on the northeastern slope of the Rocky Mountains; 19°.7 in the Missouri Valley; 19°.4 in the northern plateau region; 18°.4 on the north Pacific coast; 16°.5 in the upper lake region; 16°.4 in New England; 15°.5 in the southern plateau region; 12°.2 on the middle Pacific coast; 10°.6 on the middle-eastern slope of the Rocky Mountains; 9°.1 in the middle plateau region; 8°.1 on the south Pacific coast; 3°.9 in the middle Atlantic states; and 3°.2 in the lower lake region. For this period there was an average deficiency in temperature of 20°.0 in the Florida Peninsula; 9°.5 on the southeastern slope of the Rocky Mountains; 7°.0 in the east Gulf states; 4°.9 in the upper Mississippi valley; 4°.1 on the south Atlantic coast; 3°.0 in the Rio Grande Valley; 2°.5 in the west Gulf states; and 0°.4 in the Ohio Valley and Tennessee. It thus appears that in the upper Mississippi and Ohio valleys and in the south Atlantic and Gulf states, in which regions the current month was the warmest December ever recorded, the annual mean temperature was generally below the normal, while on the Pacific coast, where the mean temperature for December, 1889, was below the normal, the annual mean temperature was above the normal.

DEVIATIONS FROM NORMAL TEMPERATURES.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for December for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for December, 1889; (4) the departure of the current month from the normal; (5) and the extreme monthly means for December, during the period of observation and the years of occurrence:

State and station.	County.	(1) Normal for the month of Dec.	(2) Length of record.	(3) Mean for Dec., 1889.	(4) Departure from normal.	(5) Extreme monthly mean temperature for Dec.			
						Highest.	Year.	Lowest.	Year.
<i>Arkansas.</i>		°	Years	°	°	°		°	
Lead Hill.....	Boone.....	37.1	8	55.3	+18.2	55.3	1889	29.1	1884
<i>California.</i>									
Sacramento.....	Sacramento..	47.0	35	44.1	-2.9	50.9	1861	43.5	1859
<i>Colorado.</i>									
Fort Lyon.....	Bent.....	28.2	20	.....	.....	39.6	1867	17.7	1878
<i>Connecticut.</i>									
Middletown.....	Middlesex...	28.5	21	36.0	+7.5	36.0	1889	21.8	1872
<i>Florida.</i>									
Merritt's Island..	Brevard.....	61.3	5	67.7	+6.4	67.7	1889	58.0	1885
<i>Georgia.</i>									
Forsyth.....	Monroe.....	48.9	15	61.3	+12.4	61.3	1889	39.8	1876
<i>Illinois.</i>									
Peoria.....	Peoria.....	28.8	34	43.5	+14.7	44.3	1877	18.5	1876
Riley.....	McHenry.....	22.4	33	30.2	+13.8	37.7	1877	11.1	1876
<i>Indiana.</i>									
Vevay.....	Switzerland..	34.3	24	49.0	+14.7	49.0	1889	24.6	1876
<i>Iowa.</i>									
Cresco.....	Howard.....	16.3	18	31.3	+15.0	34.0	1877	4.5	1876
Monticello.....	Jones.....	21.3	35	36.9	+15.6	39.5	1877	8.1	1859
Logan.....	Harrison.....	24.6	15	39.6	+15.0	39.6	1889	15.4	1879
<i>Kansas.</i>									
Lawrence.....	Douglas.....	29.8	22	44.8	+15.0	44.8	1889	19.8	1872
Wellington.....	Sumner.....	31.5	10	46.2	+14.7	46.2	1889	23.1	1884
<i>Louisiana.</i>									
Grand Coteau.....	Saint Landry..	55.1	7	65.0	+9.9	65.0	1889	51.8	1887
<i>Maine.</i>									
Orono.....	Penobscot....	21.0	19	27.5	+6.5	30.8	1881	13.2	1872
<i>Maryland.</i>									
Cumberland.....	Allegany.....	31.5	30	43.2	+11.7	43.2	1889	24.8	1866
<i>Massachusetts.</i>									
Amherst.....	Hampshire....	33.8	43	35.7	+1.9	36.0	1881	19.5	1872
Newburyport.....	Essex.....	30.4	11	35.3	+4.9	36.5	1881	25.6	1880
Barnstable.....	Bristol.....	30.2	17	39.0	+8.8	39.0	1889	21.8	1876
<i>Michigan.</i>									
Kalamazoo.....	Kalamazoo....	28.6	13	40.2	+11.6	40.2	1889	16.7	1876
Thornville.....	Lapeer.....	27.0	12	38.0	+11.0	38.0	1889	19.6	1886
<i>Minnesota.</i>									
Minneapolis.....	Hennepin....	14.7	25	27.5	+12.8	31.6	1877	1.9	1872
<i>Montana.</i>									
Fort Shaw.....	Lewis & Clarke	25.2	21	28.2	+3.0	39.7	1875	2.2	1884

Deviations from normal temperatures—Continued.

State and station.	County.	(1) Normal for the month of Dec.	(2) Length of record.	(3) Mean for Dec., 1889.	(4) Departure from normal.	(5) Extreme monthly mean temperature for Dec.			
						Highest.	Year.	Lowest.	Year.
<i>New Hampshire.</i>		°	Years	°	°	°		°	
Hanover.....	Grafton.....	20.7	51	26.5	+5.8	31.2	1847	10.2	1872
<i>New Jersey.</i>									
Moorestown.....	Burlington...	32.2	26	41.0	+8.8	41.0	1889	23.9	1876
South Orange.....	Essex.....	31.6	19	38.6	+7.0	38.6	1889	24.3	1872
<i>New York.</i>									
Cooperstown.....	Otsego.....	27.1	35	32.7	+5.6	33.1	1881	14.7	1876
Palermo.....	Oswego.....	24.7	35	33.7	+9.0	33.7	1889	16.8	1880
<i>North Carolina.</i>									
Lenoir.....	Caldwell.....	37.6	17	48.9	+11.3	48.9	1889	29.1	1876
<i>Ohio.</i>									
N'th Lewisburgh..	Champaign...	29.9	57	44.3	+14.4	44.3	1889	19.0	1876
Wauseon.....	Fulton.....	26.6	19	38.8	+12.2	38.8	1877, '89	17.1	1872
<i>Oregon.</i>									
Albany.....	Linn.....	41.8	18	39.0	-2.8	49.5	1886	32.1	1884
Eola.....	Polk.....	40.1	10	36.1	-4.0	47.0	1886, '87	30.7	1884
<i>Pennsylvania.</i>									
Dyberry.....	Wayne.....	25.1	22	33.3	+8.2	33.3	1889	17.3	1876
Grampian Hills....	Clearfield....	25.3	25	36.7	+11.4	37.0	1877	16.0	1876
Wellaborough....	Tioga.....	29.7	10	35.0	+5.3	39.5	1881	22.6	1880
<i>South Carolina.</i>									
Statesburgh.....	Sumter.....	46.6	8	56.6	+10.0	56.6	1889	43.6	1882
<i>Tennessee.</i>									
Austin.....	Wilson.....	39.9	19	56.5	+16.6	56.5	1889	25.0	1876
Milan.....	Gibson.....	38.6	6	56.7	+18.1	56.7	1889	34.2	1886
<i>Texas.</i>									
New Ulm.....	Austin.....	53.6	16	65.8	+12.2	65.8	1889	46.1	1876
<i>Vermont.</i>									
Strafford.....	Orange.....	21.7	16	28.8	+7.1	29.5	1881	13.5	1876
<i>Virginia.</i>									
Birdsneest.....	Northampton	41.1	21	49.1	+8.0	51.1	1879	32.7	1876
<i>Wisconsin.</i>									
Madison.....	Dane.....	22.1	20	35.0	+12.9	38.7	1877	11.7	1876
<i>Washington.</i>									
Fort Townsend..	Jefferson....	41.3	14	37.2	-4.1	45.3	1885	33.0	1884

The above table shows that the mean temperature for the current month was the highest mean temperature ever noted for December at a majority of stations east of the Rocky Mountains and south of the upper lake region, and that at a number of stations in the central valleys the mean temperature of December, 1877, exceeded that of the current month.

MAXIMUM AND MINIMUM TEMPERATURES.

The highest maximum temperature reported by a regular station of the Signal Service was 88°, at Rio Grande City, Tex. The maximum values rose to or above 80° in southern and east-central Texas, at New Orleans, La., Jacksonville, Fla., and Fort Supply, Ind. T. The temperature rose to or above 70° south of a line traced from northern Maryland irregularly westward to southwestern Nebraska, thence west of south to southern New Mexico, and thence irregularly westward to southeastern California. On the Pacific coast the maximum temperature rose to or above 60° along the California coast, and, generally, over the southern half of California. The lowest maximum temperature reported was 40°, at Saint Vincent, Minn. The maximum readings were below 50° in extreme eastern New England, south of a line traced irregularly westward from the central upper lake region to southern North Dakota, thence west-northwest to north-central Montana, thence southwestward to east-central Oregon, and thence west of north over Washington, and in east-central Nevada. The reports of United States Army post surgeons and state weather service and voluntary observers show the following maximum temperatures, in states and territories where the temperature was reported 80°, or above: Citronelle and Wiggins, Ala., 82°; Fort Lowell, Ariz., 87°; Oceola, Ark., 83°; Manatee, Fla., 90°; Forsyth, Ga., 82°; Fort Supply, Ind. T., 81°; Elk Falls and Richfield, Kans., 80°; New Iberia, La., 90°; Louisville, Miss., 82°; Weston, Nebr., 80°; Simpsonville, S. C., 100°; and Fort Clark, Tex., 94°. At thirty-nine of the older established stations of the Signal Service east of the Rocky Mountains and south of the forty-fifth parallel, and at Fort Apache, Ariz., and El Paso Tex., the maximum temperature for the current month was the highest temperature ever reported for December. Among the greater excesses in maximum temperature were Sandusky, Ohio, thirteen years record, where

the maximum temperature, 70°, was 7° above the highest previous maximum reported for December, noted in 1879; Des Moines, Iowa, twelve years record, 69°, 9° above maximum of 1888; and Charlotte, N. C., twelve years record, 76°, 5° above maximum of 1884. At stations in districts east of the Rocky Mountains, except in the Florida Peninsula, the upper lake region, and the extreme northwest, where higher temperatures were noted for preceding Decembers, and not including the stations named above, the excesses in maximum temperature over the highest previous temperature for December were less than 5°. In the upper Mississippi valley and the lower lake region the highest previous maximum temperature generally occurred in 1875 or 1877; elsewhere the periods of occurrence were irregular.

The lowest temperature reported by a regular station of the Signal Service was -21°, at Saint Vincent, Minn. The minimum readings were below -10° in the more northern parts of New Hampshire, Vermont, Minnesota, North Dakota, Montana, and Idaho, and in extreme northeastern Washington, and within a limited area in northeastern South Dakota. The minimum values were below zero in northern New England, northeastern New York, north of a line traced from northern Wisconsin, west-southwest to northwestern Colorado, and thence northwestward to north-central Washington, and within an area extending over northern Nevada and west-central Utah. The highest minimum temperature reported was 63°, at Key West, Fla., and the minimum values were above 40° in Florida, except in the extreme northern part, along the west Gulf coast, and on the immediate Pacific coast from San Francisco, Cal., southward. At Keeler, Cal., five years record, the minimum temperature, 23°, on the 29th, was the same as the lowest reading previously reported for December, noted in 1887; and at Walla Walla, Wash., five years record, the minimum reading, 9°, on the 29th, was 4° below the lowest previous December minimum, noted in 1886.

The reports of United States Army post surgeons, state weather services, and voluntary observers, show the following minimum temperatures in states and territories where the temperature was reported zero, or below: Fraser, Colo., -24°; New Hartford, Conn., -2°; Soda Springs, Idaho, -18°; Eagle Grove, Iowa, -2°; Vesper, Kans., zero; Fairfield, Me., -9°; Monson, Mass., -3°; Lathrop, Mich., -8°; Morris, Minn., -17°; Camp Poplar River, Mont., -17°; Fort Niobrara, Nebr., -14°; West Milan, N. H., -22°; Fort Selden, N. Mex., -9°; Potsdam, N. Y., -8°; Fort Pembina, N. Dak., -20°; Silver Lake, Oregon, -10°; Eagle's Mere and Le Roy, Pa., zero; Webster, S. Dak., -21°; Lunenburg, Vt., -15°; Fort Spokane, Wash., -3°; Bitternut, Wis., -14°; and Saratoga, Wyo., -20°. Among extremely low temperatures reported for December of preceding years are: Fort Benton, Mont., -59°, in 1880, and -56°, in 1884; Saint Vincent, Minn., -51°, in 1873, and -48°, in 1884; Fort Assiniboine, Mont., -50°, in 1884; -34° at Duluth, Minn., in 1879, at Huron, S. Dak., in 1884, and at Yankton, S. Dak., in 1879; -39° at Saint Paul, Minn., in 1879; -25° at Denver, Colo., in 1876; -24° at Detroit, Mich., in 1872; -23° at Chicago, Ill., in 1872; -21° at Eastport, Me., in 1884; -20° at Winnemucca, Nev., in 1879, and at Fort Du Chesne, Utah, in 1887; -18° at Fort Stanton, N. Mex., in 1887, at Whipple Barracks [Prescott], Ariz., in 1879, and at Spokane Falls, Wash., in 1884; -17° at Albany, N. Y., in 1875; -15° at Indianapolis, Ind., in 1876; -5° at Charlotte, N. C., in 1880; 1° at Atlanta, Ga., in 1880; 6° at Little Rock, Ark., in 1880; 18° at Brownsville, Tex., in 1880; 22° at Cedar Keys, Fla., in 1880; 24° at Sacramento, Cal., in 1878; and 27° at Fresno, Cal., in 1887.

The lowest absolute temperature for December of preceding years has been generally noted in the middle and south Atlantic, and the east and west Gulf states, in the Rio Grande Valley, and the Ohio Valley and Tennessee, in 1880; in Florida in 1888; and over the northern plateau region, and on the north Pacific coast in 1884; elsewhere the periods of occurrence were irregular.

LIMITS OF FREEZING WEATHER.

The southern limit of freezing weather for December, 1889, is shown on chart iv by a line traced from the North Carolina coast, at Kitty Hawk, southwestward just inside of the coast line, to Mobile, Ala., thence northwestward to extreme southern Arkansas, and thence southwestward to the Rio Grande River in about longitude west 100°. The western limit of freezing weather is shown by a line traced from south-central Arizona, northwestward over central California to the coast of extreme northern California. Compared with the limits of freezing weather for November, 1889, the line showing the southern limit for the current month is about 12° farther north on the Atlantic coast, and about 5° farther north in the west Gulf states. On the Pacific coast the line of freezing weather is farther west than for the preceding month.

RANGES OF TEMPERATURE.

The greatest and least daily ranges of temperature at regular stations of the Signal Service are given in the table of miscellaneous meteorological data. The greatest monthly ranges of temperature occurred in central South Dakota, central Montana, and east-central Kansas, where they equalled or exceeded 70°. From these localities, which were located in the lower and upper Missouri valleys, the monthly ranges decreased to the central upper lake region, where they were less than 40°, thence increased to more than 60° over the interior of New England and east-central New York, and thence decreased to 30° on the extreme southeast coast of New England. From the Missouri Valley the monthly ranges decreased southward to less than 20° over extreme southern Florida; southward to less than 30° on the west Gulf coast; southwestward to less than 30° on the south Pacific coast; and westward to 20° on the middle Pacific coast, and to less than 30° on the north Pacific coast.

The following are some of the extreme monthly ranges:

Greatest.		Least.	
Valentine, Nebr.....	71.0	Key West, Fla.....	16.0
Fort Maginnis, Mont.....	71.0	Point Reyes Light, Cal.....	20.0
Northfield, Vt.....	67.0	Astoria, Oregon.....	22.0
Columbia, Mo.....	64.0	Galveston, Tex.....	28.0
Winnemucca, Nev.....	60.0	Grand Haven, Mich.....	39.0

FROST.

Owing to the unusual warmth of December, 1889, only light frosts occurred in Florida and the Gulf States. As compared with the preceding month the southern limit of frost was nearly two degrees farther north in Florida; about five degrees farther north in Texas; and about two degrees farther south in California. In Florida frost occurred in the interior of the state as far south as the twenty-eighth parallel on the 1st; generally along the immediate Gulf coast east of the ninety-fourth meridian on the 1st and 2d; in east-central Texas to the thirtieth parallel on the 30th and 31st; and in extreme southwestern California on the 8th, 14th, 28th, 29th, and 30th. In the south Atlantic and Gulf states frost was reported most frequently in Georgia, where it was noted for ten dates; in South Carolina for eight dates; in Alabama and Texas for six dates; and in Florida, Louisiana, and Mississippi for four dates. On the Pacific coast frost was reported in California for twenty-one dates; in Oregon for fourteen dates; and in Washington for twelve dates. Frost was reported in seven of the south Atlantic and Gulf states on the 1st and 3d; in six on the 2d; in four on the 4th, 5th, and 12th; in three on the 13th and 14th; in two on the 6th, 11th, and 31st; and in one on the 8th, 16th, 20th to 22d, and 30th. For dates other than those named no frost was reported in the south Atlantic or Gulf states. In California frost was reported on the 3d, 5th, 8th, 10th to 16th, 19th to 21st, 23d, and 25th to 31st; in Oregon on the 4th to 6th, 12th to 16th, and 23d to 28th; and in Washington on the 5th, 6th, 10th to 14th, 21st, 24th, 27th, 28th, and 31st.

TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature as observed at the harbors of the several stations; the monthly range of water temperature; and the mean temperature of the air for December, 1889:

Stations.	Temperature at bottom.				Mean temperature of air at the station.
	Max.	Min.	Range.	Monthly mean.	
Boston, Mass.....	43.7	40.0	3.7	41.8	38.0
Canby, Fort, Wash.....	50.0	41.5	8.5	46.6	41.2
Cedar Keys, Fla.....	76.1	59.4	16.7	68.8	63.4
Charleston, S. C.....	61.3	53.1	8.2	57.1	60.0
Eastport, Me.....	45.5	40.8	4.7	43.0	28.4
Galveston, Tex. j.....	72.0	60.0	12.0	68.7	66.4
Key West, Fla.....	73.8	68.8	5.0	72.1	71.3
Nantucket, Mass.....	44.5	38.0	6.5	42.1	39.0
New York City.....	44.0	39.6	4.4	42.2	41.4
Portland, Oregon.....	46.0	37.5	8.5	41.7	38.6

The following table shows the comparative monthly mean air temperature and monthly mean water temperature, at the surface, for the month of December in 1889 and 1876, at Atlantic coast stations having water temperature records for those months. December, 1889, was generally the warmest, and December, 1876, the coldest December on record for the Atlantic states and the districts east of the Mississippi River:

Station.	Mean temperature of the air.		Mean temperature of water.		Excess of temperature in 1889 as compared with 1876.	
	1889.	1876.	1889.	1876.	Air.	Water.
Eastport, Me.....	28.4	20.6	43.1	40.2	7.8	2.9
New York City.....	41.4	25.1	42.3	32.2	16.3	10.1
Charleston, S. C.....	60.0	43.4	57.2	46.7	16.6	10.5
Key West, Fla.....	71.3	66.1	72.2	66.5	5.2	5.7

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for December, 1889, as determined from the reports of nearly 1,800 stations, is exhibited on chart iii. In the table of miscellaneous meteorological data the total precipitation and the departure from the normal are given for each Signal Service station. The figures opposite the names of the geographical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

The greatest monthly precipitation reported for December, 1889, was 29.36, at Upper Mattole, Humboldt Co., Cal. The precipitation exceeded twenty inches in the eastern Sacramento valley between the thirty-eight and fortieth parallels, and in areas along the coast of California north of the thirty-sixth parallel, and exceeded fifteen inches at and near Los Angeles, Cal. The destructive floods attending the unusually heavy rainfall in California are referred to under the heading "Floods." The monthly precipitation exceeded ten inches in central Arizona, where 12.38 fell at Strawberry; in east-central Nevada, where 11.12 was reported at Pioche; in south-eastern Oregon, where 11.80 was reported at Bandon; and in extreme northwestern Washington, where 12.34 was reported at Neah Bay. East of the Rocky Mountains the greatest monthly precipitation was reported in limited areas in north-central and western New York, where it exceeded six inches. In areas in east-central Arkansas, western Florida, eastern Georgia, northern Indian Territory, central, south-central, and western Kansas, extreme northwestern Missouri, southeastern Nebraska, extreme southern South Carolina, central Virginia, and east-central Wyoming no precipitation was reported. Exclusive of the localities named where no precipitation was reported, less than one-half inch was noted in southeastern Alabama, southeastern Arizona, central and southeastern Colorado, west-central Illinois, southwestern Iowa, extreme southern Louisiana, southern Maryland, District of Columbia, northwestern Mississippi, central and north-central Montana, southern New Jersey, eastern and southern North Carolina, central and southwestern North Dakota, south and southeastern South Dakota, extreme southeastern Pennsylvania, western Tennessee, east-central Utah, eastern West Virginia, and north-central Wisconsin. The precipitation for December, 1889, was below the normal, except on the Pacific coast south of the forty-fourth parallel, over the western part of the plateau region, in eastern North and South Dakota, in the Lake region, and over northern New England, the lower Saint Lawrence valley, and northern New Brunswick, where the precipitation was in excess of the average for the month. The greatest

departures below the normal precipitation were noted on the North Carolina coast, where the deficiency was more than six inches at Hatteras, and at Pensacola, Fla., and on the extreme north Pacific coast, where the precipitation was more than five inches less than the December average. The deficiencies exceeded three inches in northwestern Washington, and south of a line traced from southern New Jersey south of west to extreme southern Missouri, and thence west of south to the central coast of Texas, except in southern Florida where they were less than two inches; and they were more than two inches along the coast of Nova Scotia. The greatest departures above the normal precipitation were noted on the south Pacific coast, where the rainfall exceeded the average for the month by more than twelve inches, whence the excesses diminished northward to the forty-fourth parallel, and eastward to New Mexico and Colorado. In the British Possessions east of the one hundred and twelfth meridian, and in eastern North and South Dakota, Minnesota, the Lake region, northern New England, and the lower Saint Lawrence valley the excesses in precipitation were less than one inch, except on the west Maine coast, in northwestern Minnesota, and extreme western Ontario, where they exceeded one inch, and in the lower Saint Lawrence valley, and on the coast of New Brunswick, where they were more than two inches.

Considered by districts the average percentages of the normal precipitation in districts where the precipitation was in excess of the normal were about as follows: New England, 145 per cent.; lower lake region, 112 per cent.; upper lake region, 122 per cent.; extreme northwest, 134 per cent.; southern plateau, 176 per cent.; middle plateau, 292 per cent.; northern plateau, 118 per cent.; middle Pacific coast, 228 per cent.; south Pacific coast, 420 per cent. In districts where the precipitation was deficient the percentages of the normal were about as follows: middle Atlantic states, 27 per cent.; south Atlantic states and Florida Peninsula, 5 per cent.; east Gulf states, 11 per cent.; west Gulf states, 13 per cent.; Rio Grande Valley, 6 per cent.; Ohio Valley and Tennessee, 46 per cent.; upper Mississippi valley, 62 per cent.; Missouri Valley, 95 per cent.; northeastern slope of the Rocky Mountains, 49 per cent.; middle-eastern slope of the Rocky Mountains, 11 per cent.; southeastern slope of the Rocky Mountains, less than 1 per cent.; and north Pacific coast, 71 per cent. From the above it will be seen that the greatest average excess of precipitation occurred on the south Pacific coast, where more than four times the usual amount of rain fell, and on the middle Pacific coast and in the middle plateau region, where the precipitation was more than double the usual amount for December. The greatest deficiencies are shown on the southeastern slope of the Rocky Mountains, where less